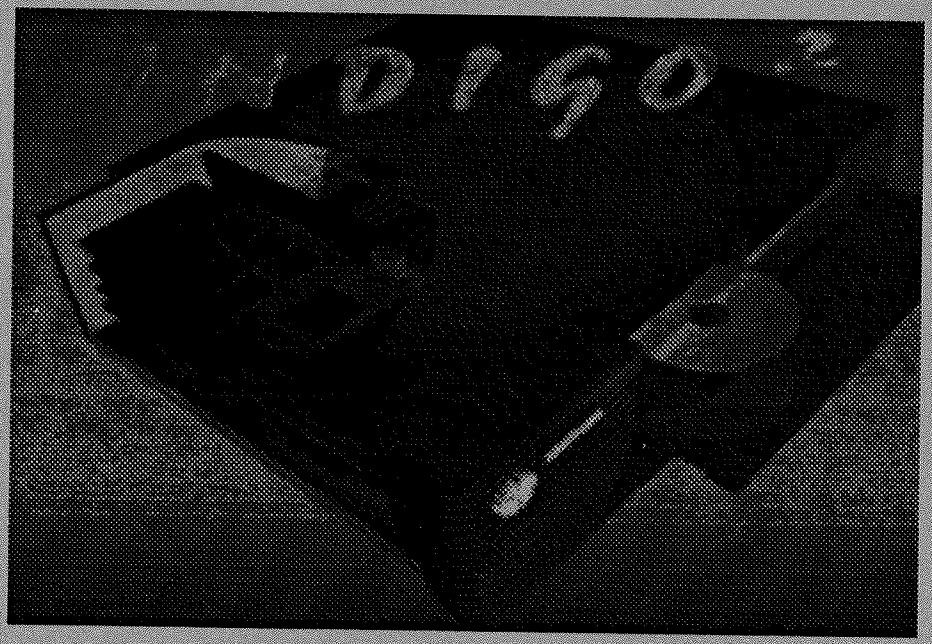
January 1993

Indigo^2 Resource Guide

Reseller Edition

Extreme Computing

"The Worlds Fastest Desktop Graphics Workstation"



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Section 1

Indigo^2 Positioning

Indigo^2 Positioning

"...SGI Announces Desktop Strategy...'INDIGO'!"

On January 26th, Silicon Graphics announced that Indigo™ is much more than the revolutionary purple desktop that turned the attention of the computing world in the summer of 1991. In fact, Indigo is much more than a color.

Indigo is the concept that drives our design philosophy.

The Indigo Family is dedicated to delivering systems for people who are faced with difficult design, visualization and compute needs. At the center of the Indigo design philosophy is a focus on real–world application performance. The key elements to Indigo Technology and application performance are:

- Fast Micro Processors
- High bandwidth system architecture
- Large caches
- Fast graphics
- Integrated digital media

In keeping with our design philosophy, Silicon Graphics made three major announcement in the Indigo Desktop Family:

Indigo Magic™:

Integrated tools that:

- let end users communicate in compelling new ways through SGI's industry leading digital media and visual environment; and
- enable developers to create exciting new applications via powerful, intuitive development interfaces.

Indigo^2 Extreme: Extends the Indigo Family

New GREEN chassis that fits under the monitor or in a stand that is included for deskside use.

- Extreme Graphics: Twice the power of Elan Graphics™
- R4400 150MHz CPU support: Availability in Q1FY94
- 64 bit wide system bus (twice the width of Indigo)
- 2 Fast SCSI Channels
- 10BaseT and AUI standard
- EISA in addition to GIO expansion
- OS 4.0.5H Easy porting of apps expected
- 1 Configuration: 32MB, 1GB Disk, and Extreme Graphics

Indigo Family: Strengthens the Indigo Family

- R4400™ for Indigo Available Q1FY94
- XZ Graphics (on R4000 & R4400 only) twice XS24Z
- 5 to 20% Price Reductions on R4000 Systems
- Disk Bundling on R4000 Systems

NOTE: Strongly recommend reading the Q&A section of this guide for overall positioning.

Section 2

Indigo^2 Extreme

Key Features

- Extreme Graphics – 2x Elan Graphics
- New Chassis – under monitor
- R4000 and R4400
- EISA/GIO Expandability and 2 Fast SCSI
- New 64 bit wide system bus
- Benchmark performance
- Improved audio capabilities

Section 3

Extreme Graphics

Indigo^2 Extreme:

Silicon Graphics announces Extreme Graphics, the industry's latest breakthrough in "realistic graphics" technology. Extreme delivers more than twice the power of Elan Graphics™ and proves SGI's long term committment to the technical, graphics intensive, desktop professional. All this just one year after the Elan announcement!

Target Markets:

- Power CAE/CAD
- Molecular Modeling
- Animation
- Visual Simulation
- Image Processing

Competition:

- HP 725 CRX48Z
- HP 735 CRX48Z
- DEC PXGT+
- Sun + E&S 1050

Extreme Graphics = Interactive 3D

Features:

- 60 & 72 Hz Support
- 24 Bit Color
- 24 Bit Z Buffer
- 1280 x 1024 Resolution
- Elan Feature Set

Performance:

- 630K Tmesh, Flat Shaded
- 415 Tmesh, G sh, lit, Z
- 155K Quads, G sh, lit, Z

Configurations:

Extreme Graphics is available on Indigo2 only and comes standard with 24–bit color, 24–bit Z Buffer.

Marketing Code:

WB–TWO50EX

Extreme Graphics delivers this phenomenal power by taking advantage of our graphics' parallel architecture. Extreme Graphics doubles the graphics pipe itself, moving to 8 Geometry Engine from the Elan Graphic's subsystem's 4, and to 2 Raster Engines from the Elan Graphics Subsystem's 1. Extreme Graphics also runs the Geometry Engine processor at a faster clock rate, delivering a class of performance that SGI's power–driven customers demand.

With 256 Mflops of peak floating point performance, Extreme Graphics distinguishes itself from the competition with the complexity of the graphics primitives being transformed. The more complex the primitive (Gouraud shaded, lighted, etc.) and the greater the quantity of vertices, the greater the utilization of the Geometry Engine processors. Similarly, for simple primitives like 3D vectors, the performance improvement is significantly less. For example:

	Elan	Extreme	%Increase
3D Vectors	1M	1.2M	20%
Tmesh (G,lit,z)	180K	415K	130%

This level of performance should come as no surprise. Interactive 3D hardware should be designed to allow our customers to create more detailed, more accurate models made up of higher quality primitives, and do so with the power to manipulate these models interactively. Extreme Graphics was designed for this task. Extreme Graphics is not an afterthought or sub–contracted option that is housed in an external shoebox outside the "system". Indigo2 Extreme is an integrated, interactive 3D solution that our customers demand from the leader in techincal computing.

Common Feature Set to the Indigo Elan Graphics Subsystem

Extreme Graphics and Elan Graphics Feature Set:

- 24–bit color
- 24–bit Z Buffer
- 4 Stencil bitplanes
- 32 simultaneous window modes
- 1280 x 1024 screen resolution
- Screen refresh rate at 60 Hz and 72 Hz
- NTSC and PAL unencoded video output timings
- Genlock capability (OS 4.0.5 and later)
- Stereo viewer control
- Sub–pixel positioning
- Multiple Windowing Environment
- Non Uniform Rational B–Spline (NURBS)
- Advanced lighting models:
  - Multiple colored light sources (8 max)
  - Ambient, diffuse, and specular lighting
  - Phong lighting
  - Spotlights
  - Local and infinite light source positioning
  - Two sided lighting
- Anti–aliased lines and points
- Full scene anti–aliasing
- High speed graphics DMA
- Atmospheric effects
- Sphere rendering
- Pixel blending for transparency effects
- Soft shadows and depth of field
- Texture mapping

Section 4

Architecture

- *System*
- *CPU*

Introduction

Designed around **MIPS R4000/R4400 processors**, the Indigo^2 system architecture is intended to bring **Extreme Computing** to the **Indigo family**.

With the EISA bus, Indigo^2 offers an attractive design with **more expansion capabilities** than the Indigo. Indigo^2 can also use high speed GIO options. The first GIO option being FDDI available in Q4 FY93. At introduction, **Indigo^2 with Extreme Graphics will only have one available EISA or GIO slot**. Future graphics options will occupy fewer slots thereby leaving more available for card expansion.

Similar to Indigo R4000, the Indigo^2 **CPU module can be upgraded** to higher clock–rate processors as they become available.

Throughput Summary

	INDIGO			INDIGO^2	
	R3000	**R4000**	**R4400**	**R4000**	**R4400**
CPU Clock	33MHz	100 MHz	150 MHz	100 MHz	150 MHz
System Bus	32bit – 133MB/sec	32bit – 133MB/sec	32bit – 133MB/sec	64bit – 266MB/sec	64bit – 266MB/sec
Memory Bus	200MB/sec peak	400MB/sec peak	400MB/sec peak	400MB/sec peak	400MB/sec peak
1st SCSI Bus	10MB/sec peak	10Mb/sec peak	10MB/sec peak	10Mb/sec peak	10MB/sec peak
2nd SCSI Bus	n/a	n/a	n/a	10Mb/sec peak	10MB/sec peak
EISA Bus	n/a	n/a	n/a	33MB/sec peak	33Mb/sec peak

Architecture Details

The numbers in the left column below correspond to the block diagram of the Indigo^2 system architecture on the following page.

Three major buses:

(1) • The **R4000 processor** running at 100 MHz and the R4400 bus running at 150 MHz with **400MB/sec** peak transfer rates.

(2) • The **GIO64 bus** runs at **25 MHz.** Compared to the Indigo Workstation's 32bit bus, Indigo^2's 64bit implementation doubles the bus bandwidth to provide **266MB/sec throughput.**

(3) • The **EISA bus** for off–the–shelf I/O cards running at **33MB/sec** peak (see features & benefits).

(4) **MC ASIC (Memory Controller)**

- The **central controller** for the system
- Provides the mechanism for the processor to access main memory, GIO64 devices, and EISA resources.
- Acts as the DMA (Direct Memory Access) master for transfers to graphics and as a DMA slave so EISA and GIO64 devices can access main memory.
- Also controls the MUX chips to perform the data crossbar function between the various buses.

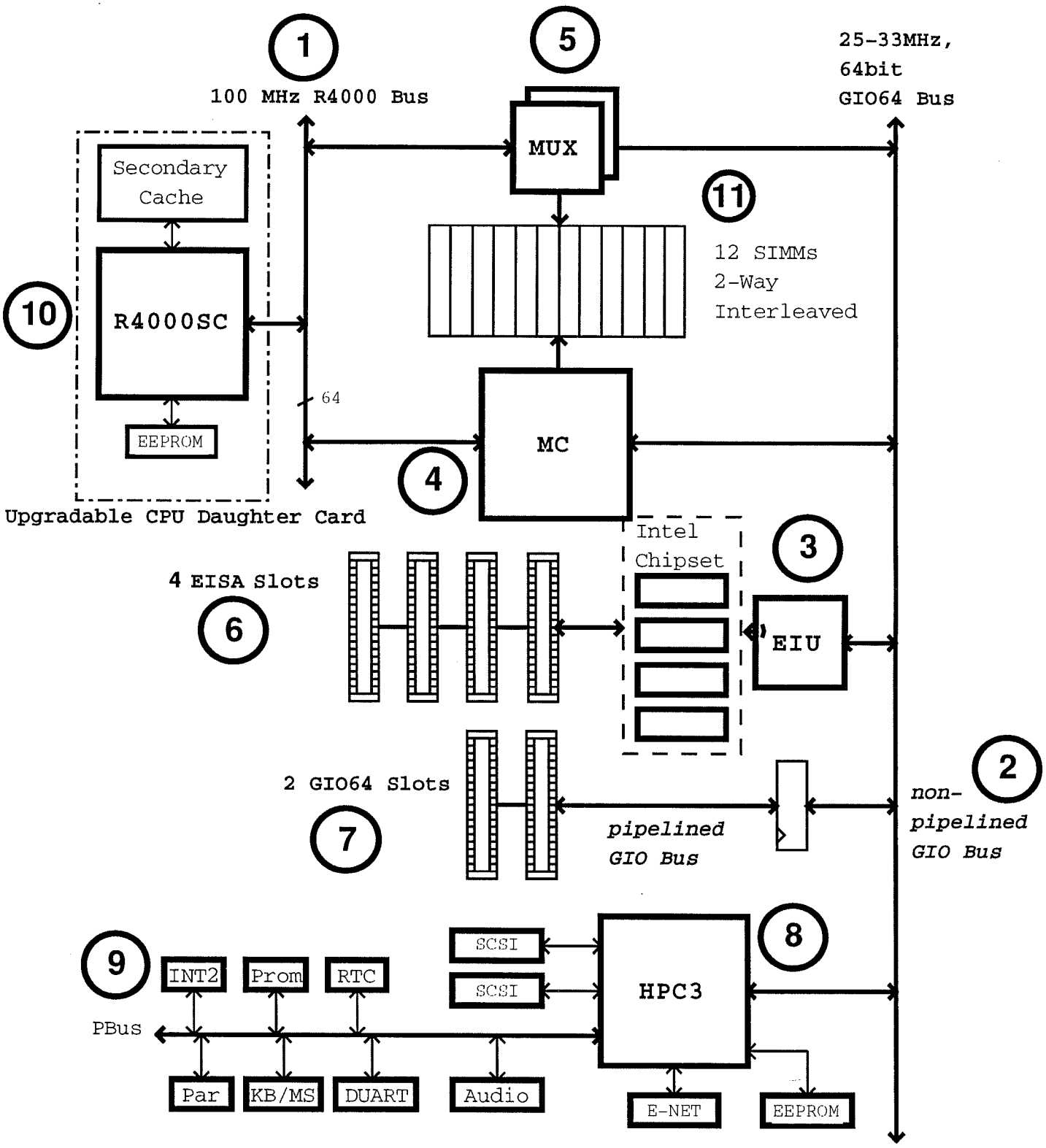
(5) **The MUX ASIC**

- **Primarily a data path chip**, with its control signals generated by the Memory Controller.
- Isolates the processor bus from the memory system, the GIO64 bus and the EISA bus and it contains synchronization FIFOs to perform flow control between the various subsystems.
- Also **performs the interleaving of main memory** to increase peak memory bandwidth.

(6) **Four EISA slots:**

- The EISA chip set from Intel and SGI's EIU chip together make the EISA bus look like a GIO64 device to Indigo^2, thus enabling the use of common EISA cards.
- **33MB/sec peak** EISA bus rate.
- ***Again, only one slot, either EISA or GIO, will be available in the box.***

Indigo^2 System Architecture Schematic



Extreme Graphics Configuration.

⑦

Two pipelined GIO64 slots

- For graphics cards and GIO expansion.
- While **only one Extreme Graphics sub-system will fit in Indigo^2**, the GIO64 slots will accomodate networking, multimedia, or any other **high-performance I/O** function.
- Both slots **support up to 64 bits** instead of Indigo's 32 bits.
- **No support for the small 3-by-5 GIO cards** used in the R3k or R4k Indigo which also require a NON-pipelined GIO bus.

⑧

The HPC3 ASIC is the central I/O controller for the machine.

- **Enhances overall system performance.**
- Two major differences between HPC3 and the older HPC's are the **64-bit interface to the GIO64 bus** (instead of 32bit) and **support for two independent channels of SCSI** (instead of one).
- The HPC3 basically collects bytes from the peripherals and packs them up into its FIFOs. When the FIFOs are sufficiently full (or empty), a DMA transfer is initiated between HPC and main memory. This **allows the peripherals to effectively communicate with main memory without tying up the CPU or the GIO64 bandwidth.**
- Provides the interface between the GIO64 bus and all of the standard workstation I/O devices.

⑨

The INT2 ASIC collects all of the interrupts from the local I/O devices and the EISA chip set and presents them to the processor via the Memory Controller.

⑩

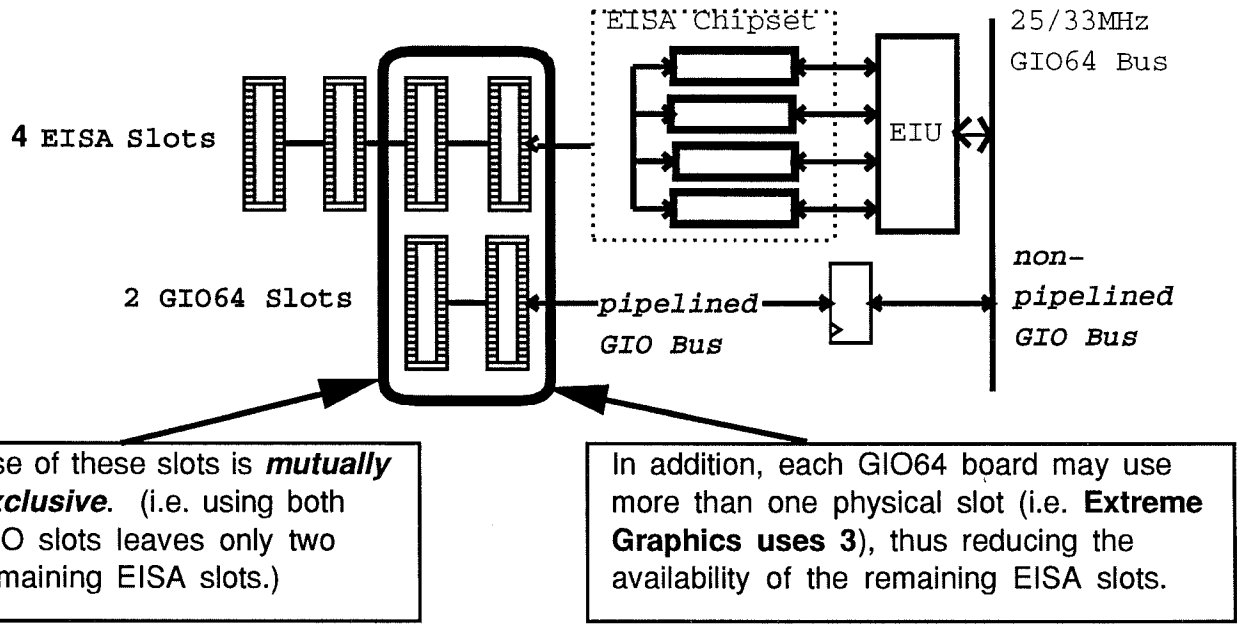
The CPU core is implemented as **a separate module.** It contains the R4000/R4400 processor, the second-level cache, the processor's clock, and a configuration ROM for the R4000. See the CPU section for more details. A separate processor module **allows for easy upgrades** to future processors as technology advances.

⑪

The Main Memory bank supports **standard DRAM,** similar to the R4000 Indigo (see attached memory section).

Features & Benefits

- **EISA**
  - Provides a large **variety of standard expansion options.**
  - Makes Indigo^2 **more customer configurable.**
  - As shown in the diagram below, Indigo^2 has **four slots of total expansion** with **four electrical connections for EISA and two for GIO64.**
  - Should both GIO64 slots be populated, only **two** EISA slots will remain available for standard I/O expansion with EISA boards (see list).
  - **Extreme Graphics** physically occupies three slots leaving **one remaining EISA or GIO slot for expansion.**



Use of these slots is ***mutually exclusive.*** (i.e. using both GIO slots leaves only two remaining EISA slots.)

In addition, each GIO64 board may use more than one physical slot (i.e. **Extreme Graphics uses 3**), thus reducing the availability of the remaining EISA slots.

Expected EISA Products from Third Parties

EISA Board	Expected Availability
2nd Ethernet	2nd half CY93
FaxModem	2nd half CY93
EISA–VME Adapter	2nd half CY93
Synchronous Serial (X.25)	2nd half CY93
Asynch Serial (6–8 ports)	2nd half CY93
Asynch Serial (8–128 ports)	2nd half CY93

FEATURES & BENEFITS CONTINUED...

- **Two GIO64 Slots**
  - GIO64 boards can use the full capabilities of the bus (both bus mastering and full 64–bit transfers) for **increased performance** and **better bus utilization**.
  - The **pipelined** implementation makes it possible to run the GIO64 bus at the rated speeds. However, because the Indigo uses a **non–pipelined** bus architecture *and* because GIO cards for the Indigo have a different form factor, **Indigo GIO cards cannot be used in Indigo^2, but FDDI is expected to be available by July 1993.**

- **GIO64 System Bus**
  - **Doubles the bus bandwidth** available in the Indigo from 133MB/sec to **266MB/sec at 33MHz** and 200MB/sec at 25MHz for increased throughput and applications performance.
  - Flexible and compatible: **accomodates both 64–bit and 32–bit devices.**

- **I/O Subsystem**
  - **Asynchronous serial ports, bi–directional parallel port, single built–in ethernet channel with autoselecting AUI OR 10BaseT connections, two Fast SCSI II controllers, 6–channel audio, and a real time clock** all built into the system for convenient networking and system expansion.
  - Expansion beyond these basic devices can be accomplished with EISA or GIO64 cards. (refer to networking section for more details).

- **Dual Fast SCSI II Interfaces**
  - Add **more external disk capacity** or **other peripherals.**
  - One channel dedicated to three internal slots.
  - Second channel is external only.
  - Total SCSI devices supported is 10

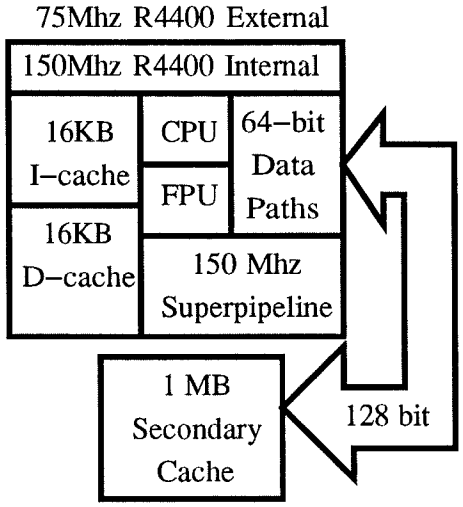
Features/Benefits of MIPS R4000 & R4400 Technology

- **Third Generation MIPS RISC Architecture**
  - Both R4000 and R4400 are single chip implementations featuring a multi–stage "superpipeline", integrated CPU/FPU and on chip first level cache.
  - The 100 Mhz R4000 processor contains over 1.4 million transitors and an on chip 8K instruction and 8K data cache.
  - The 150 Mhz R4400 processorcontains over 2.5 million transitors and an on chip 16K instruction and 16K data cache.
  - Both provide full binary compatibility for applications software with their predecessors, R2000, R3000 and R6000.
  - Balanced and equal strong integer and floating point performance.

- **64 bit processing -- An Enabling Technology**
  - Wider data path
  - Increases the performance in certain applications with 64–bit integer processing.
  - Fullfills the requirement for more virtual address space, anticipated with the next generation of applications.

- **Superpipeline Implementation**
  - Both processors contain an integrated multi–stage superpipeline, which allows these very powerful chips to operate at twice their external clock rates.

- **Multiple Cache Sizes**
  - Both the R4000 and R4400 chips allow for flexible secondary cache configurations to target specific application environments.
  - The combination of high integration and faster clock rates provides a major price / performance advantage in the microprocessor market.



R4000SC

Secondary Cache

Secondary 1MB data cache coupled with a 8K on chip instruction and 8K data cache running at 100Mhz.

Market Focus: High performance desktops and servers to maximize throughput performance.

Section 5

Memory

Note: Same configuration as Indigo R4000. Read as necessary.

Memory

Memory Architecture and Implementation

The Indigo^2 memory architecture and implementation is very similar to the **Indigo R4000**, so this section should look very familiar.

Memory Features

- Uses **standard DRAM memory** and is customer installable.
- Available in **32MB base configurations only**; no 16MB configurations.
- Supports up to **256 MB of memory at introduction** and up to 384MB of memory with the next major operating system release.
- **Memory upgrades** are available in **16MB and 32MB increments** with 64 or 128MB increments available through SGI in Q4 FY93 (see chart below). These larger upgrades will be required to acheive the full 256MB and 384MB memory configurations as shown on the configuration chart at the end of this section.
- While Indigo^2 memory is compatible with Indigo R4000 memory, Indigo^2 memory is NOT compatible with PowerSeries™, Crimson™, Personal Iris 4D/20, 4D/25, 4D/30, 4D/35, or the Indigo R3000 systems.

Memory Benefits

- Standard memory is **less expensive** for customers and **more widely available**.
- Similar to R4000 Indigo, the Indigo^2 **64 bit** memory architecture **doubles the memory bandwidth** over Indigo R3000 resulting in faster system speeds. Cache read and write data rates (memory bandwidth) of **266MB/sec** are achieved compared with 133MB/sec for the R3000 based systems.
- SIMMs for Indigo^2 and Indigo R4000 are 32 bits wide, resulting in higher throughput; R3000 SIMMs are 8 bits wide.

Quick Memory Reference Quide

Memory Upgrade	SIMM Size	DRAM Size	Marketing Code	Estimated Available
16MB	4MB	4Mbit	HU–M16A	now
32MB	8MB	4Mbit	HU–M32A	now
64MB	*16MB*	*16Mbit*	*TBD*	***June 1993***
128MB	*32MB*	*16Mbit*	*TBD*	***Sept 1993***

Memory Details

- **Current SGI upgrades** allow 96 MB of memory in the 32MB base configuration (see configuration table).

- **64MB and 128MB SIMM upgrades** utilizing 16Mbit DRAM will allow 256MB of memory with IRIX 4.0.5H and up to 384MB of memory with the next major revision of the operating system. While these upgrades may be found on the open market at introduction, estimated **availability of 64MB and 128MB upgrades from SGI is expected by July 1993.**

- Similar to Indigo R4000, **high memory bandwidth (266MB/sec)** is achieved through two–way memory interleaving, which enables a peak bus bandwidth for CPU and GIO64 transfers.

- R3000 Indigo, R4000 Indigo, and Indigo^2 all have an interleaving memory system controlled by the ASICs within each system.

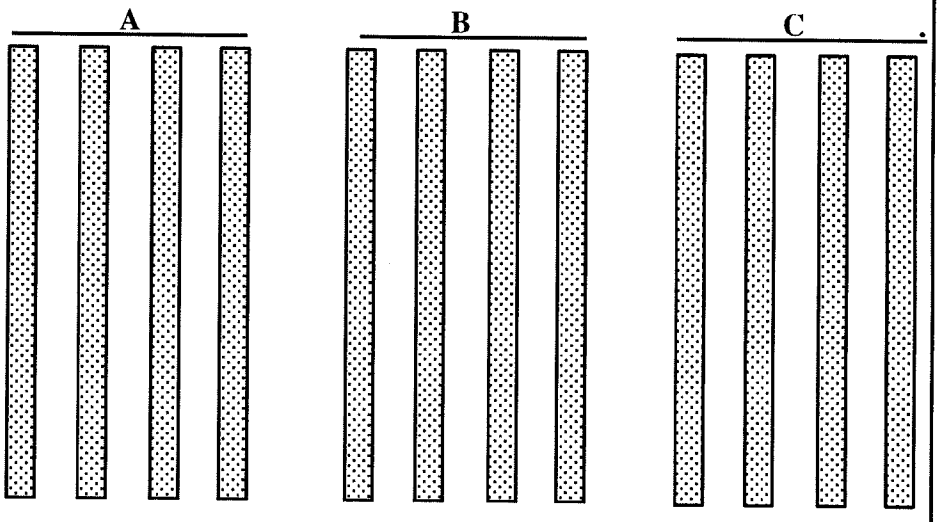
Memory Configurations

- A configuration algorithm implemented across hardware and firmware **allows the intermixing of different density SIMMs** in a given system, however, **each bank of four must be loaded with SIMMs that are the same size,** and a minimum of four SIMMS are required.

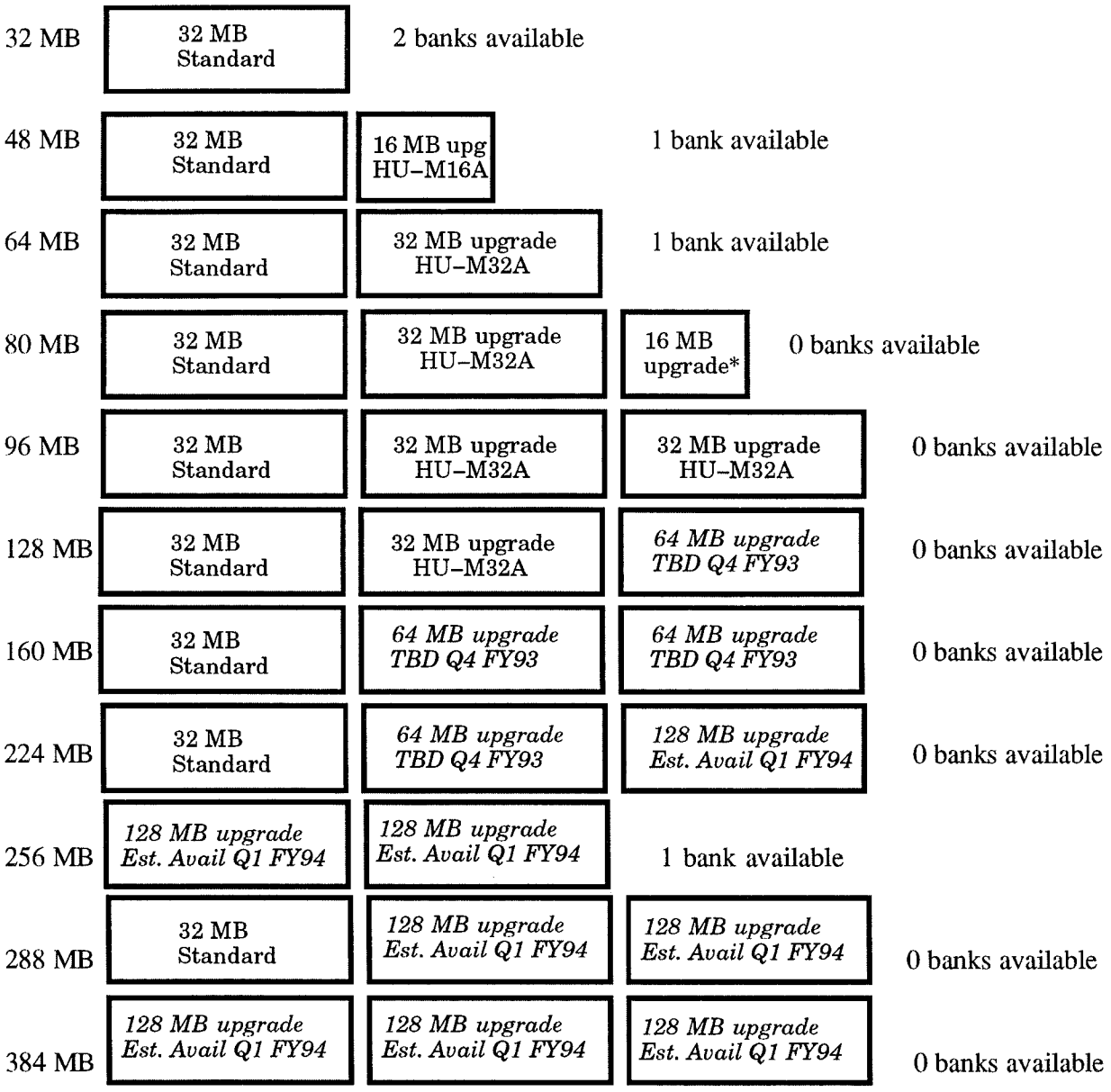
- The Indigo^2 system has **three memory banks** (four SIMMs each) similar to the current Indigo R3000 & R4000 systems. A **total of 12 SIMMs** can be put into the system, but **each bank must be filled before installing SIMMS in the next bank.**

The Indigo^2 memory board consists of three memory banks: A,B,C with 4 slots per bank.

For example, if only 32MB of memory are installed, this will fill bank C (4 x 8MB), leaving banks A and B open.



Indigo^2: 32 MB Base Configuration



Notes: *16 MB upgrade (HU–M16A) may be used for additional intermediate configurations

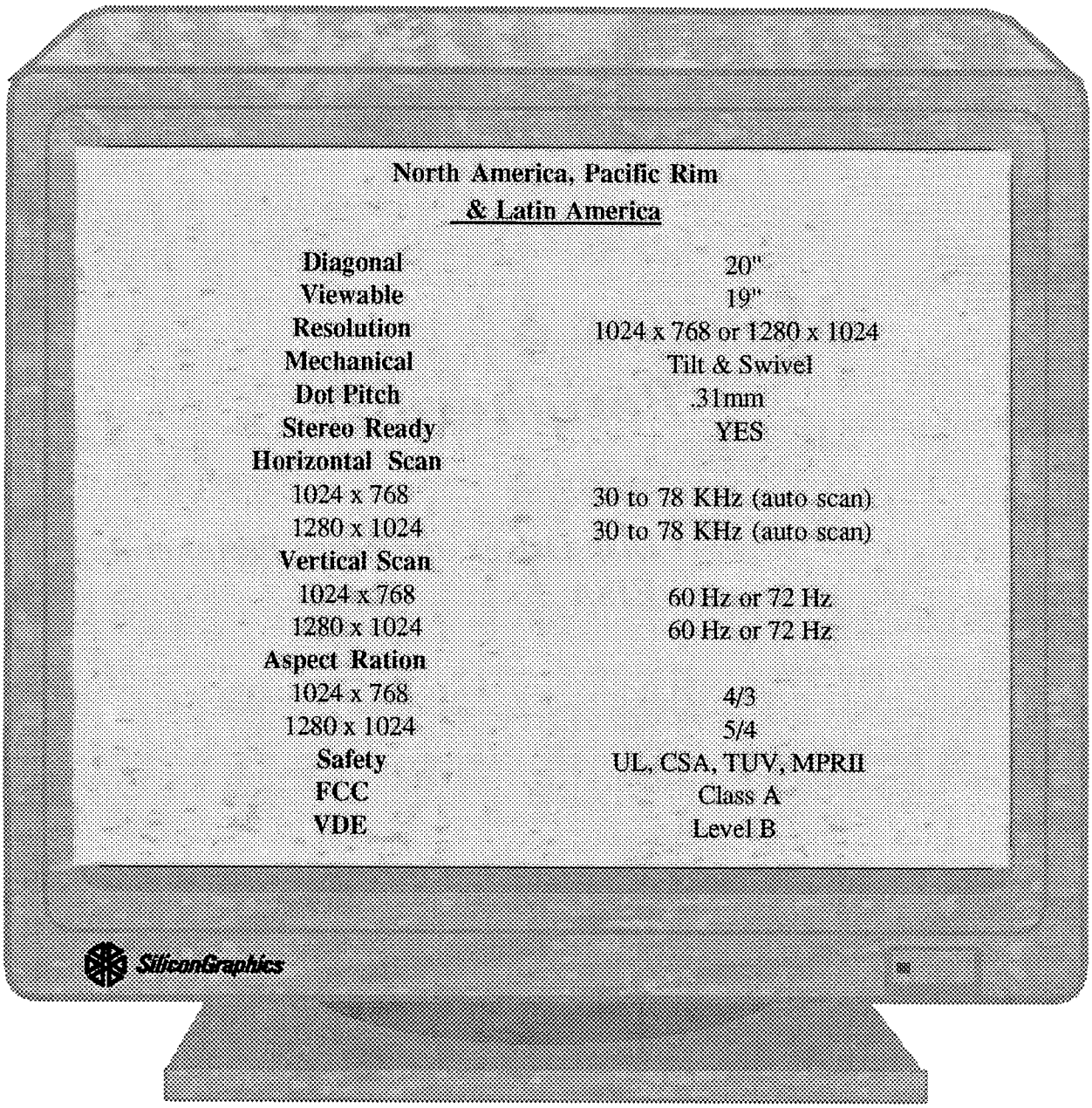
** To configure exactly 256 MB the base 32 MB must be removed

***288MB can be achieved without discarding the base 32MB by adding two 128MB upgrades.

Section 6

Monitors & Peripherals

- *Monitors*
- *Disk Drives and other Peripherals*
- *EISA*


North America, Pacific Rim
& Latin America
Diagonal 20"
Viewable 19"
Resolution 1024 x 768 or 1280 x 1024
Mechanical Tilt & Swivel
Dot Pitch .31mm
Stereo Ready YES
Horizontal Scan
1024 x 768 30 to 78 KHz (auto scan)
1280 x 1024 30 to 78 KHz (auto scan)
Vertical Scan
1024 x 768 60 Hz or 72 Hz
1280 x 1024 60 Hz or 72 Hz
Aspect Ration
1024 x 768 4/3
1280 x 1024 5/4
Safety UL, CSA, TUV, MPRII
FCC Class A
VDE Level B
SiliconGraphics

Marketing Code: D5–M96NC

- **The 19" monitor bundled with Indigo^2 is the same high quality monitor used on the current Indigo Elan products.**

Silicon Graphics Specification Requirements

	1GB 1/4"	1.3 GB DAT	New CD ROM	Floppy
Features				
Formatted Capacity	1GB	1.3 GB	650 MB	1.44 MB
I/O Interface	SCSI I	SCSI II	SCSI II	SCSI II
Form Factor	5.25"	3.5"	5.25"	3.5"
Sustained Transfer Rate	200 KB/sec	183 KB/sec	307 KB/sec	250(fm)/500(mfm) KB/sec
Latency Time	n/a	n/a	120 msec	n/a
Spindle Speed	n/a	n/a	400–1060 RPM	360 RPM
Recording Density	45,000 FSI	TBD	n/a	513(fm)/1025(mfm) KB/disk
Tape Speed	120 Inch/sec	.32 Inch/sec	n/a	n/a
Power Requirements				
DC +12 volts +/– 5%	.5 Amps	.5 Amps	.14 Amps	n/a
DC + 5 volts +/– 5%	1.5 Amps	.7 Amps	.34 Amps	.43 Amps
Power Disipation	15 Watts	<9 Watts	15 Watts	3.3 Watts
Mounting	Internal/ External	Internal	Internal/ External	Internal
Marketing Code				
Internal/	P9–1GQIC	P9–T13D	P9–CDR–2	P9–F2S2
External	P9–1GQICA		P–CDR–2A	
Shipping	----------w/Indigo^{2}release----------			

Benefits:

- Dual speed CD ROM on Indigo^2 reads data at twice the speed and offers faster search mode for audio. The rates improve from 155 KB/sec to 307 KB/sec.

Competitive Edge:

- Delivers outstanding I/O performance.
- All peripheral devices are customer removable and installable.
- 3.5" and 5.25" form–factor devices meet industry standard requirements.

Other Peripherals:

- External peripherals available on the Indigo R3000 and R4000 are compatible with Indigo^2.
- External Indigo peripherals need a new SCSI cable (X5–SCSI) for attachment to Indigo^2.
- Indigo R3000 and R4000 internal peripherals cannot be used with Indigo^2
- Indigo^2 uses a standard PC keyboard and mouse.

Silicon Graphics Specification Requirements

	236 MB Disk	432 MB Disk	1.0 GB Disk*
Features			
Formatted Capacity	236 MB	432 MB	1.0 GB
I/O Interface	SCSI II	SCSI II	Fast SCSI II
Form Factor	3.5" x 1.625"	3.5" x 1.625"	3.5" x 1.625"
Sustained Transfer Rate	1.6–2.3MB/sec	1.6–2.3MB/sec	2.3MB/sec
Avg. Seek Time Read	14 millisec	14 millisec	12 millisec
Avg. Seek Time Track to Track	2.5 millisec	2.5 millisec	2.6 millisec
Latency Time	6.8 millisec	6.8 millisec	7 millisec
Spindle Speed	4412 RPM	4412 RPM	4317 RPM
Power Requirements			
DC +12 volts +/– 5%	2.0 Amps	2.0 Amps	2.7 Amps
DC + 5 volts +/– 5%	0.9 Amps	0.9 Amps	1.1 Amps
Power Disipation	13 Watts	13 Watts	10.9 Watts
Marketing Code			
System disk	NA	NA	Bundled
Option disk	P9–D20S	P9–D40S	P9–D1GS

Note: Indigo^2 drives are not interchangeable with Indigo drives.

Shipping ----------w/ Indigo^2 Release----------

* SGI plans to qualify a faster (higher sustainable date transfer than the current Indigo 1.2GB drive) 1.0 GB drive in Q4 FY93. **SGI will ship the faster 1.0 GB drive on first customer ship date if available.**

Benefits:

- Indigo^2 will be bundled with a 1.0 GB fast SCSI II system drive. Option drives will be available in the 236MB, 432MB, and 1GB capacity.
- The 1.0 GB fast SCSI II has a sustainable transfer rate of 2.3MB/sec across the whole disk.
- The 236MB and 432MB drives

Competitive Edge:

- Devices deliver outstanding I/O performance.
- Both system and option disks are customer removable and installable.
- 3.5" form–factor devices meet industry standard requirements.

This standard, called the Extended Industry Standard Architecture (EISA) 32–bit bus, was formally introduced in 1989. With the introduction of this 32–bit bus, a need for 32–bit add–in cards was generated. Indigo^2 EISA implemention fully conforms to version 3.12 of the EISA Industry standard.

Planned EISA Products from Third Parties

Silicon Graphics is currently pursuing these planned products for delivery in the second half of CY93.

Company	Product	Shippable
• Intel	Fax / Modem	2H CY93
• Specialix	Asynchronous serial (8–128 ports)	2H CY93
• Systems Strategies	Synchronous serial card	2H CY93
	IBM connectivity and X.25	2H CY93
• BIT3	EISA to VME Expansion	2H CY93
• BusLogic	EISA Ethernet	2H CY93

EISA Marketplace Description

****The following is a brief list of the types of markets in which EISA solutions are found****

Networking:

2nd Ethernet	Additional Ethernet ports
Synchronous Serial	This card is necessary for full IBM (X.25, SNA, etc)
Token Ring	To provide connectivity with one of the highest growth networking solutions on the market
FDDI	High speed connectivity, very important to high end users who need to move large amounts of data around quickly
ISDN	Emerging standard, early adoption in Europe and Pacific

Communication:

Asynchronous Serial	Terminal, Modem, and other peripheral devices
FAX/Modem	High speed (up to 14.4K) FAX and Modem

Other:

EISA/VME	Provides Bus to Bus connection. Geared towards Systems Integrators and research environments that provide both the VME board and the application.

Section 7

Physical and Environmental Specifications

Indigo^2 Physical & Environ. Specs.

CPU:	• 5 inches H x 18.5 inches W x 18.5 inches D • 42 lbs	12.7 cm H x 46.99 cm W x 46.99 cm D 19.1kg
Monitors:		
• **19 inch Monitor:** (48.3cm)	• 18.7 in. H x 18.9 in. W x 19.9 in.D • @ 71.6 lbs.	47.5cm H x 48cm W x 50.5cm D @32.48kg
Power Requirements:	• Voltage and Frequency 100–120/200–240 VAC, 8/4A. 47–63 Hz • 120 V 2.5A (without monitor) • 120 V 2.5A (with monitor) • 19" Monitor: 100–120v/200–240v, 2.5/1.3A, 50/60Hz	
Heat Dissipation:	• 2700 BTU/hour	
Ambient Temperature:	• +13 to +35 degrees C operating • –40 to +65 degrees C non–operating	
Acoustic Noise:	• 36 dB(A) in operating position	
Relative Humidity:	• 10% to 80% operating no condensation • 10% to 95% non–operating no condensation	
Altitude:	• 10,000 feet operating • 40,000 feet non–operating	3047.85M operating 12191.40M non–operating
Vibration:	• 0.02 inches, 5–19Hz • 0.35G, 19–500Hz	0.508mm

Regulatory Agency Compliance:

R3000/R4000 XS, XS24, Elan & R4000 Entry:

Electromagnetic Emissions:

- FCC Class A
- Canada DOC, Class A
- CISPR 22 Class A
- EC EN55022 Class A
- Germany Vfg 251/1991 Class A
- Japan VCCI Class 1

Product Safety:

- UL 1950; CSA 22.2, No. 950: IEC 950:
- EN 60950; Class 1, SELV.

Ergonomic/Health:

- Germany ZH618
- ISO 9241

Section 8

Digital Media

- *Indigo Magic*
- *Audio*
- *Video*
- *Markets*

Section
Digital Media

What's New...

New Selling Concept – Indigo Magic

New Audio/Video Hardware Capabilities

New Media Mosaic/Showcase Capabilities

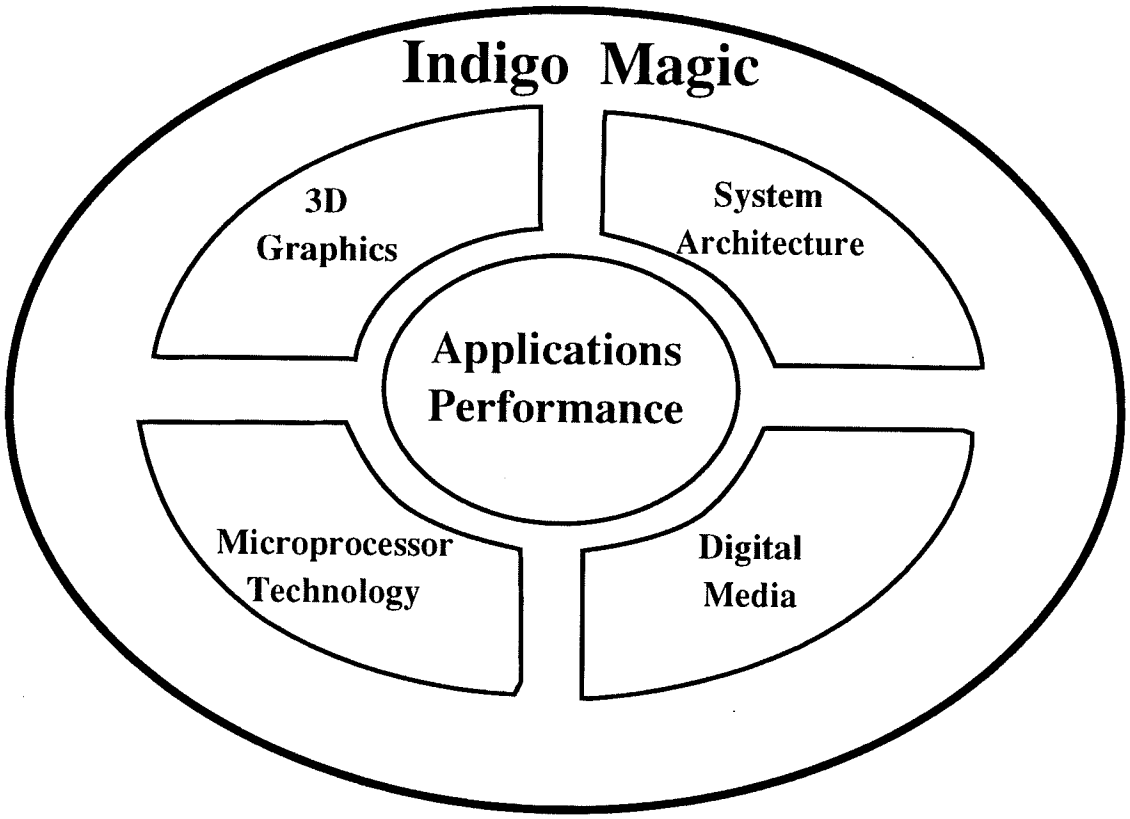
Third–Party Digital Media Applications Directory

Market Segments Come into Focus

What's In This Section.....

Indigo Magic
Indigo Family Excels in Digital Media – 10 Reasons
Indigo^2 Audio Hardware
Indigo^2 Video Hardware
IRIS Media Mosaic/IRIS Showcase
Digital Media Applications Directory
Digital Media Market Segments

- Indigo Magic – innovative software tools running on powerful workstations – is a concept setting SGI apart from the competition
- Indigo Magic provides access to SGI's core technologies, giving users and developers Power and Control.
- Indigo Magic helps you sell by giving a special aura to SGI.



USERS

DEVELOPERS

POWER

CONTROL

Indigo Magic – The "Out–of–Box Experience"

- The "Out–of–Box–Experience" means two things – ***bundled software*** is available "right–out–of–the–box" AND Indigo Magic ***unleashes the power*** built into the "box".

- Indigo Magic has many components:

End Users

IRIS Insight™
Media Mosaic™
Showcase™
Image Tools
Media Mail
Digital Media Clip Library*
Impressario™

Developers

CASEVision™
Digital Media Development Libraries
Iris Explorer™
Iris Inventor™
ImageVision Library™

* Digital Media Clip Library includes many things:

Prosonus Sounds
Inventor Models
Showcase Objects
Explorer Objects
Movie Player Movies

Indigo Magic – A Strategic Process for Desktop Work

With the versatility of Indigo Magic, you can impress customers with state–of–the–art advancements in desktop productivity. The key is enhanced communication. Challenge our competition to provide these capabilities!

Investigate – IRIS Insight communicates the capabilities of the system, interactively teaching users about the system. Use Inventor, Explorer when working with complex datasets and models.

Create – Create audio, video, images with Media Mosaic, Image Tools, Digital Media Clip Library. Developers create with Explorer, Inventor, Digital Media Development Libraries, ImageVision Library, CASEVision.

Compose – Choreograph creations with Showcase.

Interact – Talk to others thru Z–Mail using not only text, but voice and Movie Player movies, check print jobs with Impressario.

Indigo Family Excels in Digital Media – Ten Reasons

INDUSTRY RECOGNITION – SGI leads the industry in the high–end computer animation market. With the Indigo family, SGI is bringing this technology to the desktop.

PERFORMANCE – the Indigo family dramatically reduces desktop rendering times using SGI's optimized system design. Indigo/Indigo^2* allow you to create and mix 3D graphics and live video.

BUILT–IN DIGITAL MEDIA – the Indigo family makes Digital Media easy and versatile, with built–in audio, video–ready graphics, and Media Mosaic Digital Media Tools.

SUPERIOR DESIGN – the Indigo family's fast internal architectures integrating audio, video, 3D graphics, and Media Mosaic is unmatched on the desktop. The SCSI bus supports lossless recording and playback of CD music data to/from a DAT drive or Hard disk. The GIO bus and memory I/O are very fast, making the high demands of video and audio input/output easy to handle.

WORKING WITH MACINTOSH – network Indigo / Indigo^2 to existing Macintosh workgroups. Rendering frames 10 to 50 times faster on Indigo / Indigo^2, the Mac user creates animations much faster! Indigo / Indigo^2 meet the needs of Mac users in many ways: fast rendering, read/write Mac–format files, run common applications.

THIRD–PARTY APPLICATIONS – the Indigo family is attracting a wide variety of third–party Digital Media applications at more affordable prices. These new applications complement the traditional high–end animation and rendering applications running on SGI's broad family of workstations and video products.

EASE–OF–USE – Media Mosaic is easy to use. Record music, mix with voice, capture images and live video, create movies! Plug in the mic, headphones, CD–ROM, DAT for a complete audio environment. Add video*, VCR, camera for video input/edit/output.

EXPANDIBILITY – the Indigo family is designed for growth in many ways – CPU, graphics, improved audio/video capabilities.

NETWORKING – the Indigo family is comfortable stand–alone or in networks of thousands of systems, sporting the fastest network technologies on the desktop.

PRICE – standard audio, video–ready graphics, low–cost video add–ons, and bundled software make the Indigo family the best deal in Digital Media.

* see Video Hardware section for information on Indigo^2 video

Audio Features

Having high–quality audio in Indigo is a success (notice our competitors' recent inclusion of audio). With Indigo^2, the new audio system provides all the features of Indigo audio, and more. SGI–designed chips eliminate the need for a DSP chip.

- Indigo^2 has the same excellent audio capabilities as Indigo
  - 16–bit, two–channel stereo audio, up to DAT sample rates
  - (Stereo–capable) Microphone, headphones, speaker
  - Analog line in, analog line out, digital serial in/out

- Indigo^2 has extra features today
  - Stereo microphone input channel
  - Shielded speaker, for "cleaner" emissions (minimizes effect of magnetic speaker coil on graphics display)
  - Supports internal CD–ROM drive
  - Internal CD–ROM drive has twice the bandwidth of the existing Indigo external CD–ROM drive (307 KB/sec vs. 150 KB/sec, respectively)

- Indigo^2 will do even more in the future

In addition to the above, Indigo^2 will provide extended functionality, **when the corresponding software is developed. These are not yet supported in Media Mosaic or Digital Media Development Libraries**.

- 4 analog channels in (using stereo mic input and analog line input)
- 4 analog channels out (using headphone out jack and analog line out)
- 2 digital serial channels in
- 2 digital serial channels out
- All channels will be able to operate simultaneously, for a total of six channels in and six channels out (Indigo has a maximum of two channels in and two channels out)
- Continuous sample rates will be supported: Indigo supports specific sample rates (For instance, with Indigo audio, 22.05K or 32K are selectable, but Indigo^2 allows a setting of 24.7K or 24.8K, etc.)
- Built–in clock hardware will support time–stamping of audio data (for synchronization). This will be useful for audio/video editing or playback.

Video Hardware in the Future

Today, IndigoVideo is available for Indigo Entry graphics. The video board for the Elan Graphics family – includes XS, XS24, XZ (2 Geometry Engine processors), Elan (4 Geometry Engine processors), and Extreme Graphics (8 Geometry Engine processors) – is under development. It is expected in the second half of calendar 1993. Its capabilities are similar to IndigoVideo, and include:

– live video in/out. Formats supported include:
composite (VHS)
S–Video
YUV (Betacam)
– 24–bit color – real–time and single–frame output
– RGB out
– Digital ports for connection to additional video–related hardware (such as a hardware compression board)

Additional Video Information

Currently under development is a board supporting JPEG compression in hardware. This will be useful for recording, editing, and playback of video at full resolution (640x480 for NTSC) and full frame rates (30 frames per second) with minimal loss in visual quality. Availability timeframe is not yet known, but will be close to Elan video availability.

Third–party Solutions

There are solutions today from third parties that can provide one or more of the video functions that Elan video will provide. For more information, see the new Applications Directory "Publishing & Digital Media Applications Directory, Spring '93".

IRIS Media Mosaic/Showcase

IRIS Media Mosaic/Showcase provide a competitive advantage today, with ease of use, versatility, and price (bundled with IRIX) being the keys. Continue to push the advantage of IRIS Media Mosaic™, combined with our Digital Media hardware capabilities.

Showcase can be used for on–line design reviews, interactive learning environments, information kiosks, and presentations.

Customers are using Showcase / Media Mosaic in a variety of ways: as sketch tools, for interactive presentations, print–to–video, and display & study of scientific data. For instance, animating a series of still frames with the Movie tools to show changes in a physical process, a simulation, or spectral analysis of materials.

IRIS Media Mosaic in the Future

New IRIS Media Mosaic tools (2nd half Cal. '93) will provide easy–to–use creation and editing capabilities for 3D objects (Inventor–based), MIDI, and images.

Showcase in the Future

IRIS Showcase 3.0 will support import, creation, and simple editing of IRIS Inventor–based 3D objects with full color & textures. Showcase will support compound links, or scripting (i.e. several events can be triggered serially with a single click on an object). Availability is projected for Calendar Q2, 1993.

New Digital Media Applications

There will be a new catalog of Digital Media applications –"Publishing & Digital Media Applications Directory, Spring '93" – please obtain a copy for the latest software, hardware, and contact information. It is expected in February, 1993.

Products are available in the following areas:

VideoEditing
Music Composition
Audio Editing
Animation
Paint Packages
Animation Controllers
Special Effects – 3D Titling, Digital Effects, etc.

See the new "Publishing & Digital Media Applications Directory, Spring '93" for third-party information.

Bringing Digital Media Market Segments into Focus

This is a summary of Digital Media markets, as we see them today. These may change as our products change, and as new uses for Digital Media are developed.

There are five basic markets for Digital Media:

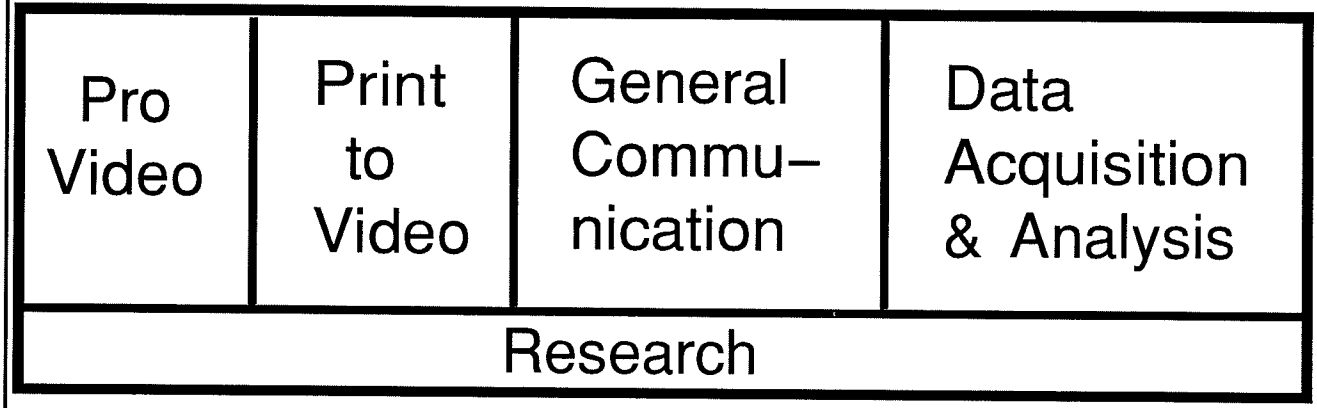
1) **Professional Video**: television, film, commercials, music. Also corporate and institutional videos.

2) **Print to Video**: Engineers/Scientists/Designers print graphics to videotape for communication (sending videotapes to a co–worker / using at presentations, etc.)

3) **General Communication**: delivering information through video and audio within workgroups (videoconferencing, e–mail) or interactively (information kiosks, learning environments running on the user's system, such as SpaceTour / IRIS Insight–based tech pubs), or as–yet undeveloped uses such as hands–free operation of workstations using speech recognition, voice–synthesis for messaging, etc.

4) **Digital Media Research**: Universities want to be involved with multi–media. Their research may include any of above markets.

5) **Analytical Digital Media** (data acquisition and analysis using Digital Media)**:** There are many applications where audio and video can enhance a complex process of collecting and analyzing data. Included are Image Processing, Sports Performance Analysis, Medical Modelling, Manufacturing Quality Assurance.



Section 9

Networking

Indigo^2 Networking

- Indigo^2 built–in network support:
  - Ethernet supporting:
    - 10BaseT
    - AUI
- GIO Card Development
  - FDDI – available June '93

- Third Party EISA Development
  - For information on card availability and/or developer support contact: Gloria Grotjan, Independent Hardware Vendor Program Manager.

Other Available Products:

- NFS
- NetVisualyzer™
- Spectrum ™
- 5080 Emulator
- DECnet
- LAT Emulator
- 3270/TCP Emulator

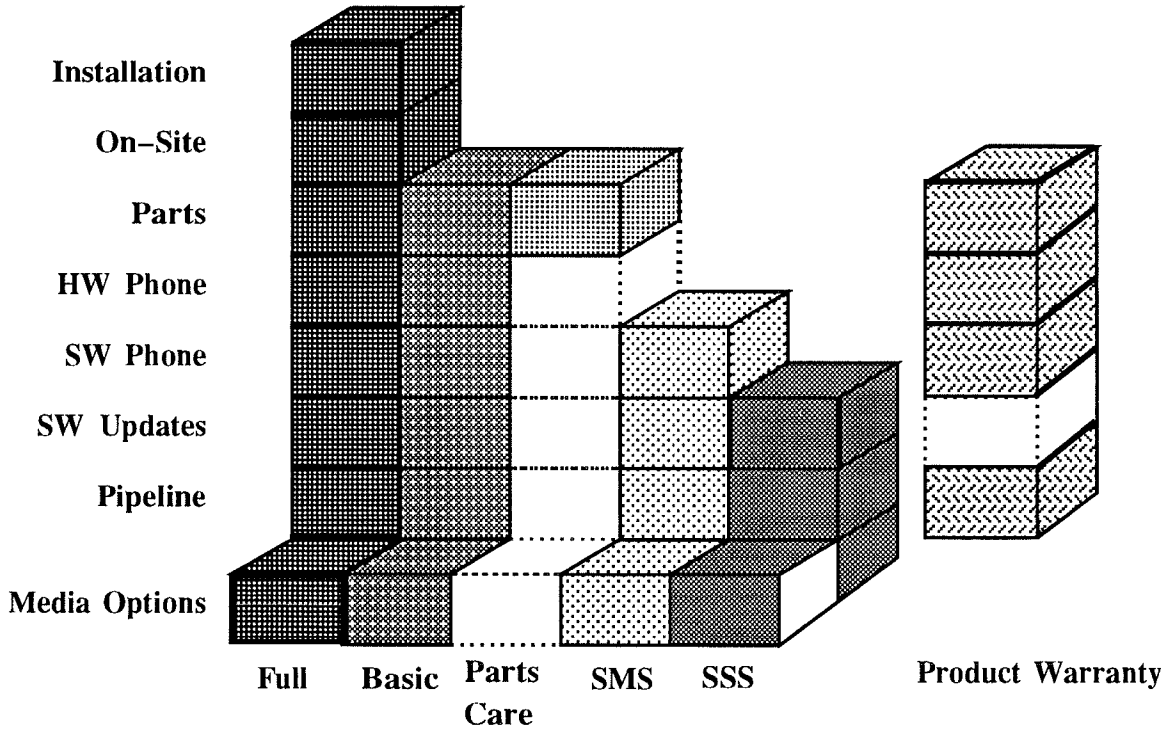
Section 10

Customer Support

- *Support Options*
- *EISA Support*

Support Options

Customers purchasing support will have the standard support options available to them. The programs are illustrated below:



EISA Support

Customers who purchase "Gold Seal" EISA boards have the option of covering them under their Full, Basic or Parts Care support contract by purchasing the marketing code **CS–EISA.** SGI will troubleshoot and manage restoration of defective Gold Seal EISA boards for customer who have elected to purchase CS–EISA.

CS–EISA ***must*** be purchased in conjunction with either Full or Basic Support/Extended Warranty or Parts Care. It ***cannot*** be purchased in conjunction with SMS or SSS or as a stand–alone support program.

For More information on Support Programs, contact your SGI sales representative.

Section 11

Competition

Overall:
- **CPU**
- **Graphics**
- **Apps Throughput**
- **Expandability**

CPU:
+Integer performance in price range
+on 50 MHz.
+on 75MHz
– Maximum FP performance
• Floating point performance in price range
~on 50 MHz.
~on 75MHz

Graphics:
• Solids (tri's and quads) Competition: HPCRX48Z
– Watch for 715/50 CRX48Z
+ HP needs 99MHz to compete in quads (see price).

Overall:

Indigo2 Extreme combination offers customers an excellent blend of CPU performance, graphics, application throughput and expandability. This section summarizes the following detailed comparisons versus other major workstation vendors and highlights SGI's important differentiators.

CPU

SGI has a clear integer performance advantage. In order to match Indigo2's SPECint92 performance, HP and IBM must propose more expensive systems since their machines are heavily biased toward floating point performance. To reach or surpass the 50Mhz, 59 SPECint92 number, HP must offer the 735/755 ($40k/$60k entry color) and IBM must propose the 580 ($70k entry color). To reach the 75Mhz, 80 SPECint92 number, even DEC and Sun must start at $40k (entry color) systems.

In uniprocessor floating point performance, HP now holds the lead with 150 SPECfp92. IBM and DEC follow closely with 125 SPECfp92. SGI currently requires multiprocessing systems to achieve these numbers. To reach the Indigo2 workstation's 75Mhz SPECfp92 number of 85, most vendors are price competitive except Sun which must jump to a $40k multiprocessing system (entry color). All major competitors except Sun reach SGI's 100Mhz SPECfp92 number of 61 for $15–$20k(entry color).

Graphics

In solids modeling (triangles and quads), only HP's CRX48Z competes directly with Extreme . With 600k trangles/sec, the 715/50CRX48Z at $28k will provide serious competition. However, to

Graphics:

Competition: HP & IBM w/ accelerators

+ Sun/DEC < half Extreme
  Expect Sun/E&S Freedom
+ DEC doesn't have anything to offer today. (Developinging next gen graphics, Kubota for Alpha graphics.)

attain the 150k quads/sec, HP needs 99Mhz systems starting at a much higher $53k for the 735CRX48Z. IBM's high–end GTO graphics competes with Elan, not Extreme

Existing Sun and DEC graphics are less than half the performance of Extreme. Sun will emphasize the Freedom 1000 from Evans and Sutherland in the future. DEC is still developing its next generation graphics and Kubota will supply high end graphics for Alpha workstations.

Application Throughput:

+ System Bus Speeds
+ Memory Bus Speeds
+ CPU cache
+ Disk I/O

Application Throughput

The best indicators of SGI's application throughput are application benchmarks and the AIM benchmark. The AIM suite of tests measures maximum user load and maximum throughput in jobs/minute while exercising all major hardware subsystems. Indigo and Indigo^2 reach AIM performance levels two to three times faster than competitive models.

Even without actual application benchmarks, bus speeds, CPU cache and disk I/O demonstrate SGI's throughput superiority.

With the Indigo^2 workstation's sustained 266 Mbytes/sec system bus, SGI claims the industry's best system architecture. DEC's Turbochannel performs at 37% the speed of Indigo^2 (100MB/s), Sun's S–bus performs at 30% the speed (80MB/s), and IBM's Microchannel bus performs at 15% the speed (40MB/s) .

The Indigo^2 workstation's peak memory bus speed of 400 MB/s beats the Sparc10's M–Bus (320MB/s) and the HP755's peak memory bus speed of 264 MB/s.
The HP735 and 755 are the only workstations with fast and wide disk I/O running at

20Mbytes/sec, while the Indigo2 workstation's disk I/O runs fast, but not wide at 10Mb/sec. However, the 735 and 755 possess less than one–half of Indigo2's CPU cache, critical for large applications.

Expandability:
- ~ 4 slots common
  More expensive systems for DEC/Sun.
- + Only SGI& HP have EISA
- + 2 Fast SCSI IIchannels
- + Internal CDROM
- • See following page for slots available per graphics configuration.

Expandability

• SCSI Expansion

The second SCSI II channel on Indigo2 provides customers the potential for great internal and external peripheral expansion. With the possiblity of seven devices per channel(only 3 on the internal channel), customers have the flexibility and capability to add peripherals as required.

• Total Expansion Slots

All major workstation vendors currently sell or have announced workstations with four system expansion slots. (If customers require four slots, rather than three, DEC and Sun must offer a more expensive chassis). However, only SGI and HP workstations offer EISA slots, which is a competitive advantage due to its "openness." TurboChannel from DEC and Sbus from Sun are proprietary.

• Expansion Slots with Graphics Accelerators

Indigo2 configured with Extreme Graphics leaves only one EISA slot open. HP accelerators consume fewer slots. All of HP's graphics accelerators utilize one EISA slot on the 715 and 725, but no EISA slots on the 735 and 755. This allows customers to expand graphics with a remaining three slots on the 725, one slot on the 735, four slots on the 755, but no slots at their low end 715.

IBM's 3D graphics accelerators utilize two MicroChannel slots for 8 bit graphics and three slots for 24 bit graphics. The 340 and 350, start with four available slots each, so customers are left with two and one slots open for 8 and 24 bit graphics, respectively.

Competition – CPU Match Up

	Mips			HP–PA			TI for Sun		
	R3000/33	R4000/100	R4400/150	7100/33	7100/50	7100/99	microSPARC/50	Spr SPARC/40	SPARC
Clock(MHz)	33	100	150	33	50	99	50	40	40
Cache I/D Kb	64k+64k	8k+8k/1Mb	16k+16k/1Mb	64/64	64/64	256/256	4k+2k	20k+16k/1Mb	32+32k
MIPS	30	85	120*	41	62	124	59.1	109.5	28.5
MFlops	4.2	16	22*	8.9	13.2	40.8	4.6	22.4	4.2
SPECMarks (89)	26	70	100*	46	69	147	22*	66*	2.5
SPECint92	22	59	82*	24	36.5	80	22.8	53.2	21.8
SPECfp92	24	61	86*	45	72	150	18.4	63.4	22.8
Systems Using	Indigo R3K	IndR4K	Ind^2	715/33	715/50	735	SClassic	SS10/41	SStn2
					725/50	755	SparcstnLX		

	Mips			IBM			DEC		
	R3000/33	R4000/100	R4400/150	Power33	Power 42	Pwr PC	R3K for DEC240	Alpha/133	Alpha/150
Clock(MHz)	33	100	150	33	42	50	40	133	150
Cache I/D Kb	64k+64k	8k+8k/1Mb	16k+16k/1Mb	8k+32k	8k+32k	32k	64k+64k	8k+8k/512Kb	8k+8k/512
MIPS	30	85	120*	50	—	—	42.9	129.9	146.7
MFlops	4.2	16	22*	14.8	18.6	—	5.9	26.4	30.1
SPECMarks (89)	26	70	100*	56.6	71.4	51*	32.4	110	121.5
SPECint92	22	59	82*	27.7	34.6	39*	27.3	65.3	74.3
SPECfp92	24	61	86*	51.9	65.0	50*	29.9	111	125.1
Systems Using	Indigo R3K	IndR4K	Ind^2	IBM 340	IBM 350	(future)	DEC5000/240	DEC3000/400	DEC3000/500

* Means Estimated

	Indigo R4000 Elan	Indigo 2 100 MHz Extreme	HP 715/50 CRX–24Z	HP 725 CRX–48Z	HP 735 CRX–24Z	HP 755 CRX–48Z	IBM 340 or 350 8 bit	IBM 340 or 350 24 bit	Digital 3000/400 PXGT+	Digital 3000/500 PXGT+
Number of Slots (Unconfigured System)	2 GIO32	4 EISA 2 GIO64	1 EISA	4 EISA	1 EISA	4 EISA	4 MCh	4 MCh	3 TCh	6 TCh
Slots Used by Graphics	0	3	1	1	0	0	2	3	3	3
Net slots avail. (In Configured System)	2	1 EISA or GIO	0	3	1	4	2	1	0	3

Strengths and Challenges for SGI

Strengths	Challenges
Overall	
•Strong corporation. Solid financial picture. • Smaller size allows SGI to dynamically address the needs of customers and prospects in the marketplace. • Platform is becoming more widely accepted by general users. • #1 in customer satisfaction 2yrs running.	• Still seen mostly as a "niche player" popular in the "lunatic fringe" laboratories with the technical wizzards. • Price points tend to present challenges for entering the 2D and commercial marketplace.
System Attributes	
•Upgradability. • Binary code compatibility throughout the product line.	
CPU	
• Robust, mature operating sustem. • Strong compilers. • Indigo Magic – communication & creation • Graphics – still the industry leader with a clear future, not so for DEC/SUN/IBM • CPU – leading architecture, 64 design, MP systems, manufacturing partners worldwide. • Digital Media – Leading the industry in this market. Competition had to react to Indigo.	• Moving to Fast/Wide SCSI (20Mb/sec) in the future. • EISA expandability and number of vendors currently supplying. • Upcoming availability of Express Video. • 6 channel audio in future OS release. • Volume availability of R4400.
Expandability	
	• With Extreme Graphics, only 1 open slot.

	IndigoR4000	Indigo 2/100	Indigo 2/150	HP 715/50		HP 725	
CPU:	R4000	R4000	R4400	PA 7100/50	PA 7100/50	PA 7100/50	PA 7100/50
Graphics	Elan	Extreme	Extreme	CRX-24Z	CRX-48Z	CRX-24Z	CRX-48Z
Color Planes	24	24	24	24	48	24	48
Z Buffer	24	24	24	24	24	24	24
2D Vectors K/sec	1M	1.2M	1.2M	604	803	604	803
3D Vectors K/sec	1M	1.2M	1.2M	680	1000	680	1000
T Mesh K/sec (flat, No Z)	370	630	630	150	600	150	600
T Mesh K/sec (G-sh, Z)	230	--	--	--	--	--	--
(G- Shaded, Lit, Z)	65	415	415	--	--	--	--
Independent Quads K/sec (G-sh,Z)	110	--	--	--	--	--	--
(G- Shaded, Lit, Z)	65	115	115	65	80	65	80
System Benchmarks, Architecture & Expandability:							
Benchmarks: AIM	72.1	72.1*	--	33.7	33.7	--	--
Khornerstone	215						
DP Linpack	16	16	22	13.2	13.2	13.2	13.2
Architecture: System Bus (MB/Sec)	133 sus	266 sus	266 sus	132 peak	--	--	--
Mem Bus(MB/Sec)	266sus	266 sus	266 sus	--	--	--	--
Disk I/O (#, speed)	1SN 5Mb/s	2F 10Mb/s	2F 10Mb/s	1SN 5Mb/s	1SN 5Mb/s	1SN 5Mb/s	1SN 5Mb/s
Expandability Slots	2 GIO	4 EISA	4EISA	1EISA	1 EISA	4EISA	4EISA
Memory (max.)	384	384	384	400	400	768	768
Disk: Internal max.	3.6GB	3GB	3GB	2GB	2GB	4GB	4GB
External max.	4.8GB	--	--	124GB	124GB	239GB	239GB
Networking	FDDI	FDDI	FDDI	Ethernet	Ethernet	Ethernet	Ethernet
Baseline Configuration							
Memory/Disk	16/432	32/1Gb	32/1Gb	16/525	16/525	32/1000	32/1000
Display	19"	19"	19"	19"	19"	19"	19"
(Resolution)	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024

* means estimated

2F means 2 Fast SCSI II channels, FW means Fast & Wide.

	INDIGO R4000	Indigo 2/100	Indigo 2/150	HP 735		HP 755	
CPU:	R4000	R4000	R4400	PA 7100	PA 7100	PA 7100	PA 7100
Graphics	Elan	Extreme	Extreme	CRX-24Z	CRX-48Z	CRX-24Z	CRX-48Z
Color Planes	24	24	24	24	48	24	48
Z Buffer	24	24	24	24	24	24	24
2D Vectors K/sec	1M	1.2M	1.2M	652	1.2M	652	1.2M
3D Vectors K/sec	1M	1.2M	1.2M	680	1900	680	1900
T Mesh K/sec (flat, No Z)	270	630	630	175	600	175	600
T Mesh K/sec (G-sh, Z)	230	--	--	--	--	23	23
(G- Shaded, Lit, Z)	65	415	415	--	--	--	--
Independent Quads K/sec (G-sh,Z)	110	--	--	--	--	--	--
(G- Shaded, Lit, Z)	65	155	155	95	150	95	150
System Benchmarks, Architecture & Expandability:							
Benchmarks: AIM	72.1	72.1*	--	71.7	71.7	71.7	71.7
Khornerstone	215	--	--	**These Numbers Are Not Yet Published			
DP Linpack	16	16	22	40.8	40.8	40.8	40.8
Architecture: System Bus (MB/Sec)	133 sus	266 sus	266 sus	--	--	--	--
Mem Bus(MB/Sec)	266sus	266 sus	266 sus	264 peak	264 peak	264 peak	264 peak
Disk I/O (#, speed)	1SN 5Mb/s	2F 10Mb/s	2F 10Mb/s	1FW 20Mb/s	1FW 20Mb/s	1FW 20Mb/s	1FW 20Mb/s
Expandability Slots	2 GIO	4 EISA	4 EISA	1 EISA**	1 EISA	4 EISA**	4 EISA
Memory (max.)	384	384	384	400	400	768	768
Disk: Internal max.	3.6GB	3GB	3GB	2GB	2GB	4GB	4GB
External max.	4.8GB	--	--	124GB	124GB	239GB	239GB
Networking	FDDI	FDDI	FDDI	FDDI	FDDI	FDDI	FDDI
Baseline Configuration							
Memory/Disk	16/432	32/1Gb	32/1Gb	32/525	32/525	64/2GB	64/2GB
Display	19"	19"	19"	19"	19"	19"	19"
(Resolution)	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024

* means estimated

2F means 2 Fast SCSI IIchannels, FW means Fast & Wide.

Strengths	Challenges
Overall	
• Very well established company. • #2 workstation vendor in terms of revenue. • Strong service and support reputation. • Broad UNIX systems offering spans both commercial and technical marketplaces. • 1 year warranty	• New systems in short supply for software partners. • 725 not shipping until April 1993. -- This is a consistent, chronic problem, related to getting from the CPU development stage into the "real life" working system stage. • Product line lacks mid-range workstation offering ($25K range, US dollars). • No new architecture on the low end. • Customers ranked SGI first in overall customer satisfaction, compared to HP's #4 ranking! (DQ survey) • Customers ranked SGI ahead of HP in technical process and technical performance. (DQ survey)
System Attributes	
• New, aggressive price points. • Fast/Wide SCSI on the high end (735, 755). • More systems choices at the low end. • Disks bundled	• Fast/Wide SCSI (20Mb/sec transfer rates) for the high end only. Low end customers are relegated to Slow/ "Narrow" SCSI (5Mb/sec rate). • Indigo^2's 2 Fast SCSI II channels provide greater peripheral expandability at a 10Mb/sec transfer rate.
CPU	
• Fast floating point performance. • Benchmarks well where standard benchmark numbers are key.	• PA architecture is unbalanced. -- Tuned for Specs, but not applications • How will they get to 64Bit? • Spec code fits in cache, so Spec port not necessarily representative of Apps performance.
System Software	
• 3D support for Xterminals with PowerShade. • MPower multimedia software application.	• PowerShade price increased 5% to $2100 ($US). For MPower: • First generation toolset; •Does NOT come standard with system ($495, $US). • No delivery until early 1993. • MPower does not even come close to Indigo Magic tools. No comparison!

Strengths	Challenges
Support	
• Bundle 1 year of maintenance with systems. • Excellent service and support reputation.	
Applications	
	• New systems in short supply for software partners. • Customers ranked HP sixth out of 8 workstation vendors for satisfaction related to the number of applications offered. SGI ranked second (behind Sun).

SGI vs. Sun -- Low-Mid Range

	IndigoR4000	Indigo 2/100	Indigo 2/150	SparkstationLX	Sparkstation2		
CPU:	R4000	R4000	R4400	microSPARC/50	SPARC		
Graphics	Elan	Extreme	Extreme	GXPlus	GXPlus	GS	GT
Color Planes	24	24	24	8	8	24	48
Z Buffer	24	24	24	none	none	16	24
2D Vectors K/sec	1M	1.2M	1.2M	480	480	480	480
3D Vectors K/sec	1M	1.2M	1.2M	310	310	150	500
T Mesh K/sec (flat, No Z)	370	630	630	--	--	--	--
T Mesh K/sec (G-sh, Z)	230	--	--	--	--	20	100
(G- Shaded, Lit, Z)	65	415	415	--	--	--	--
Independent Quads K/sec (G-sh,Z)	110	--	--	--	--	--	--
(G- Shaded, Lit, Z)	65	155	155	--	--	--	--
System Benchmarks, Architecture & Expandability:							
Benchmarks: AIM	72.1	72.1*	--	--	15.4	15.4	15.4
Khornerstone	215	--	--	--	43K	43K	43K
DP Linpack	16	16	22	4.3	4.2	4.2	4.2
Architecture: System Bus (MB/Sec)	133 sus	266 sus	266 sus	80 peak	80 peak	80 peak	80 peak
Mem Bus(MB/Sec)	266s,	266 sus	266 sus	--	--	--	--
Disk I/O (#, speed)	1 SN 5Mb/s	2F 10Mb/s	2F 10Mb/s	--	--	--	--
Expandability Slots	2 GIO	4 EISA	4 EISA	2 Sbus	3 Sbus	3 Sbus	3 Sbus
Memory (max.)	384	384	384	96	128	128	128
Disk: Internal max.	3.6GB	3GB	3GB	424Mb	848Mb	848Mb	848Mb
External max.	4.8GB	--	--	22Gb	20.8Gb	20.8Gb	20.8Gb
Networking	FDDI	FDDI	FDDI				
Baseline Configuration							
Memory/Disk	16/432	32/1Gb	32/1Gb	16/400	32/424	32/424	32/424
Display	19"	19"	19"	16" color	19" color	19" color	21" color
(Resolution)	1280x1024	1280x1024	1280x1024	1024x768	1280x1024	1280x1024	1280x1024

* means estimated

2F means 2 Fast SCSI II channels, FW means Fast & Wide.

SGI vs. Sun -- Mid-High Range

	IndigoR4000	Indigo 2/100	Indigo 2/150	Spkstn 10/30		Spkstn 10/41	
CPU:	R4000	R4000	R4400	SuperSPARC/36		Super SPARC40	
Graphics	Elan	Extreme	Extreme	GS	GT	GT	Freedom 1050
Color Planes	24	24	24	24	48	48	24
Z Buffer	24	24	24	16	24	24	24
2D Vectors K/sec	1M	1.2M	1.2M	480	480	480	--
3D Vectors K/sec	1M	1.2M	1.2M	150	500	500	500
T Mesh K/sec (flat, No Z)	370	630	630	--	--	--	--
T Mesh K/sec (G-sh, Z)	230	--	--	20	100	100	--
(G- Shaded, Lit, Z)	65	415	415K	--	--	--	--
Independent Quads K/sec (G-sh,Z)	110	--	--	--	--	--	--
(G- Shaded, Lit, Z)	65	155	155	--	--	--	--
System Benchmarks, Architecture & Expandability:							
Benchmarks: AIM	72.1	72.1*	--	37	37	44.3	44.3
Khornerstone	215	--	--	--	--	--	--
DP Linpack	16	16	22	10.6	10.6	17.2	17.2
Architecture: System Bus (MB/Sec)	133 sus	266 sus	266 sus	80 peak	80 peak	80 peak	80 peak
Mem Bus(MB/Sec)	266 sus	266 sus	266 sus	288 peak	288 peak	320 peak	320 peak
Disk I/O (#, speed)	1SN 5Mb/s	2F 10Mb/s	2F 10Mb/s	1F10 Mb/sec	1F10 Mb/sec	1F10 Mb/sec	1F10 Mb/sec
Expandability Slots	2 GIO	4 EISA	4 EISA	4 Sbus	4 Sbus	4 Sbus	4 Sbus
Memory (max.)	384	384	384	128 or 512	128 or 512	128 or 512	128 or 512
Disk: Internal max.	3.6GB	3GB	3GB	2 Gb	2 Gb	2 Gb	2 Gb
External max.	4.8GB	--	--	41 Gb	41 Gb	41 Gb	41 Gb
Networking	FDDI	FDDI	FDDI				
Baseline Configuration							
Memory/Disk	16/432	32/1Gb	32/1Gb	32/424	32/424	32/424	32/424
Display	19"	19"	19"	19" color	21" color	21" color	
(Resolution)	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024

* means estimated

2F means 2 Fast SCSI II channels, FW means Fast & Wide.

Strengths

Overall

- #1 in Worlwide Workstation marketshare.
- Industry leader, due to sheer company size and shipping volume.

System Attributes

- Low, LOW price points.
- Provide multiple expansion slots, even at the low end.
- Multimedia–capable on the low end.
- Disks are bundled with systems as a standard operating procedure.
- 1 year factory warranty on some systems (including LC and LX).
- Fast expected performance on the 40MHz Super SPARC.

Notes & Thoughts about Sun:

Sun's offering seems to work for people and application who only need to "make do" with an "adequate" machine. (A user can get the job done with little cost in the short run, due to low, LOW pricing.) For any needs that push the envelope, or could have needs that grow (won't YOURS grow, Mr. Customer? Sun quickly becomes an expensive and inadequate computing solution.

Challenges

Overall

- Sun has a legacy of making technical promises they can't keep. This should spell a lack of personal and company integrity to customers and prospects!
- Low profit margins recently.
- Sun ranked sixth in Dataquest's overall customer satisfaction. SGI ranked first.
- Sun focuses on the commercial user and their needs NOT the technical user.
- Subcontracting graphics development.

System Attributes

- SLOW system bus!
  --System Bus speed is only 80MB/Sec.
- Multimedia capabilities are limited; No available tools to utilize the capabilities.
- Must utilize an S Bus slot for graphics.

CPU

For SuperSPARC:

- Fast performance on 40MHz SuperSPARC, but only if it ships! Where is it?? (See personal integrity and company integrity comment above.)
- R4000/100 and R4400/150 bracket the performance quoted by Sun for the microSPARC/40.
  --R4000/100 performs at comparable rates, better Mips/MFlops AND it's shipping today!
  --R4400/150 exceeds in speeds/feeds.
- Low chip yields and difficulty raising clock rates due to a bi–CMOS implementation.
-- Will likely have difficulty raising clock further.

(Compare CPU impact on systems and ensuing capabilities.)

For SPARC:.

- Integer arithmetic, contains no integer multiply or divide instruction sets.
- Digital Media technology is not integrated into the system architecture.

Strengths	Challenges
System Software	
	• Sun recently switched sources for compilers on SparcStation10 systems. It's not clear why, but some industry experts suppose that they may be achieving SPEC numbers with compilers that may not yet ship with the systems. — This also raises questions about new compiler availability, cost and support. — This also raises questions about how well the new compilers will mesh with Sun's programming • Ugly operating environment.
Applications	
• Huge number of applications. Customers very pleased with this (Dataquest survey).	

SGI vs. IBM Mid–Range

	IndigoR4000	Indigo 2/100	Indigo 2/150	IBM 340		IBM 350
CPU:	R4000	R4000	R4400	Power 33	Power 33	Power 42
Graphics	Elan	Extreme	Extreme	Gt4x	GTO	GTO
Color Planes	24	24	24	8/24	8/24	8/24
Z Buffer	24	24	24	24	24	24
2D Vectors K/sec	1M	1.2M	1.2M	800	990	990
3D Vectors K/sec	1M	1.2M	1.2M	800	990	990
T Mesh K/sec (flat, No Z)	370	630	630	80	120	120
T Mesh K/sec (G–sh, Z)	230	—	—	—	—	—
(G– Shaded, Lit, Z)	65	415	415	—	—	—
Independent Quads K/sec (G–sh,Z)	110	—	—	—	—	—
(G– Shaded, Lit, Z)	65	155	155	—	—	—
System Benchmarks, Architecture & Expandability:						
Benchmarks: AIM	72.1	72.1*	—	28.4	28.4	36.2
Khornerstone	215	—	—	—	—	88K
DP Linpack	16	16	22	14.8	14.8	18.6
Architecture: System Bus (MB/Sec)	133 sus	266 sus	266 sus	40 peak	40 peak	40 peak
Mem Bus(MB/Sec)	266s,	266 sus	266 sus	264 peak	264 peak	336 peak
Disk I/O (#, speed)	1SN 5Mb/s	2F 10Mb/s	2F 10Mb/s	1SN 5Mb/s	1SN 5Mb/s	1SN 5Mb/s
Expandability Slots	2 GIO	4 EISA	4EISA	4 MChannel	4 MChannel	4 MChannel
Memory (max.)	384	384	384	256	256	512
Disk: Internal max.	3.6GB	3GB	3GB	2GB	2GB	6GB
External max.	4.8GB	—	—	33.8GB	33.8GB	42.8GB
Networking	FDDI	FDDI	FDDI			
Baseline Configuration						
Memory/Disk	16/432	32/1Gb	32/1Gb	16/160	16/160	32/400
Display	19"	19"	19"	19" color	19" color	19" color
(Resolution)	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024

sus = Sustained Rate peak = Peak Rate *means estimated 2F means 2 Fast SCSI II channels, FW means Fast & Wide.

Strengths

Overall

- Top–down, politically astute selling style.
- Brand loyalty of "IBM bigots" in industry.
- Revenue in workstations grew over 100% (1990 to 1991) with market share almost doubling.
- Named the #3 workstation supplier world wide by Dataquest for 1991.

System Attributes

- High price per SpecMark.

CPU

- Good floating point performance.
- Good CPU benchmark numbers.

Challenges

Overall

- Financial instability, evidenced by recent lay off announcements.
- May not be able to sustain technology growth with drastic reductions in R&D investments.
- Keep market valuation above asset value.
- RS6000 is canabalizing mini business
- Mainly commercially focused like SUN.

System Attributes

- Utilizes proprietary MicroChannel expansion slots.
- Small cache.

CPU

For Power 33 and Power 42:

- R4400 soundly beats IBM's Power 42 and 33 CPU's in every CPU performance parameter (see CPU Matchup).
- R4000 beats the Power 33 (CPU for IBM's 340) numbers and competes with the numbers for Power 42 (CPU for IBM's 350).
- Not much primary or secondary cache. No off–chip cache to offset this, either.

For RIOS/6000:

- Small datapaths; only 32 bits wide.

Areas to WIN:

- **Graphics**
- **Price/Performance**
- **$/SPECmark**
- **Superior Operating System**
- **No confusion of shifting to Apple/IBM products down the line**

	IndigoR4000	Indigo 2/100	Indigo 2/150	DEC 240		DEC3000/400	DEC3000/500
CPU:	R4000	R4000	R4400	R3000	R3000	Alpha/133	Alpha/150
Graphics	Elan	Extreme	Extreme	PXG+24	PXGT+	PXGT+	PXGT+
Color Planes	24	24	24	24	48	48	48
Z Buffer	24	24	24	24	24	24	24
2D Vectors K/sec	1M	1.2M	1.2M	335	445	445	445
3D Vectors K/sec	1M	1.2M	1.2M	401	436	436	436
T Mesh K/sec (flat, No Z)	370	630	630	—	—	—	—
T Mesh K/sec (G–sh, Z)	230	—	—	—	—	—	—
(G– Shaded, Lit, Z)	65	415	415	70	106	106	106
Independent Quads K/sec (G–sh,Z)	110	—	—	—	—	—	—
(G– Shaded, Lit, Z)	65	155	155	—	—	—	—
System Benchmarks, Architecture & Expandability:							
Benchmarks: AIM	72.1	72.1*	—	33.1	33.1	—	—
Khornerstone	215K	—	—	37K	37K	—	—
DP Linpack	16	16	22	6.0	6.0	26.4	30.1
Architecture: System Bus (MB/Sec)	133 sus	266 sus	266 sus	100 peak	100 peak	90 peak	100 peak
Mem Bus(MB/Sec)	266sus	266 sus	266 sus	—	—	—	—
Disk I/O (#, speed)	1 S/N 5Mb/s	2 F 10Mb/s	2 F 10Mb/s	—	—	—	—
Expandability Slots	2 GIO	4 EISA	4 EISA	3TurboChnl	3 TurboChnl	3 TurboChnl	6 TurboChnl
Memory (max.)	384	384	384	480	480	128/512Mb	256Mb
Disk: Internal max.	3.6GB	3GB	3GB	0 Mb	0 Mb	2.1Gb	4.2Gb
External max.	4.8GB	—	—	24.8Gb	24.8Gb	7.4Gb	7.4Gb
Networking	FDDI	FDDI	FDDI	Ethernet	Ethernet	FDDI/ISDN	FDDI/ISDN
Baseline Configuration	16/432	32/1Gb	32/1Gb	16/426	16/426	16/426	
Memory/Disk	19"	19"	19"	19"color	19"color	19"color	19"color
Display	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024	1280x1024
(Resolution)							

* means estimated

2F means 2 Fast SCSI II channels, FW means Fast & Wide.

Strengths	Challenges
Overall	
• Huge installed base (especially VAX). • Very strong, reliable networking solution. • Good reputation for reliable, quality products.	• New CEO. • Financial instability • Huge $ invested in shaky endeavors (Alpha). • Rocky migration path for VMS to Alpha customers. • Is Alpha really a savior? Does it raise more issues than solutions? • Customers ranked Digital fourth in their overall satisfaction ranking for workstation manufacturers. They ranked SGI #1. • Reorganized sales force and product divisions. • Laid off TRIAD Group, responsible for Turbo Channel development. Future?
System Attributes	
	• High price tag for exotic, proprietary architecture. • When will higher end graphics REALLY ship? • Future of Dec graphics dependent on Kubota.
CPU	
• Fast chip and well priced.	• R4400/150 estimates compete well with Alpha's CPU numbers. • Trouble finding a foundry for Alpha. • Chip runs VERY hot. • Huge power requirements (2x the requirements of R4400/150). • Production yield problems due to unusual chip technology.

Strengths	Challenges
System Software	
• Customers love VMS.	• When will OSF1 really ship? • SGI has very good, solid DEC connectivity and emulation solutions. • DEC doing the NT port to Alpha (without Microsoft's support). — Can they afford this resourse outlay? — Why no support? MTI has had MS support for a long time on the NT project. • O/S move required for ALL customers. — VMS (VAX) to VMS (Alpha) — Ultrix (VAX) to OSF/1 (Alpha)
Support	
• Very strong support story. • Digital will support other manufacturer's systems at a cusotmer site.	

Section 12

Ordering and Sales Tools

- *New Product Codes*

Ordering Tools – Product Codes

	Systems
WB–TWO50EX	INDIGO2, 50MHZ, EXTREME GFX, 32MB memory, 19" monitor, 1.0GB system disk
	Upgrades
HU–TWO75	75MHZ CPU Ugrade for INDIGO2
	System Disks
NOT APPLICABLE–	INCLUDED IN THE SYSTEM BUNDLES
	Disks
P9–D20S	236MB (formatted) SCSI Option Disk, 3.5"
P9–D40S	425MB (formatted) SCSI Option Disk, 3.5"
P9–D1GS	1.0GB (formatted) Fast SCSI–II Option disk, 3.5
P9–D1GS5	1.0GB (formatted) Fast SCSI–II Option Disk, 5 1/4" brackets
	Memory
HU–M16A	16MB Memory Upgrade for Indigo2 and Indigo R4000
HU–M32A	32MB Memory Upgrade for Indigo2 and Indigo R4000
HU–M64A	64MB Memeory Upgrade for Indigo2**(avail. Q4 FY93)**
HU–M128A	128MB Memeory Upgrade for Indigo2**(avail. Q4 FY93)**
	Peripheral Options
P9–CDR–2	Dual Speed (300KB/Sec), Internal CD ROM, 5 1/4"
P9–CDR–2A	Dual Speed (300KB/Sec), External CD ROM, 5 1/4"
P9–1GQIC	1 GB QIC internal SCSI Tape Drive
P9–1GQICA	1 GB QIC external SCSI Tape Drive
P9–T13D	4MM Digital Audio SCSI Tape Drive
P5–T2R2	1/2" 9 Track
P9–F2S2	3.5" SCSI Floppy Disk Drive
P5–DIAL	Dials Box
P5–BBXD	Dials & Buttons
D–VCON	VideoCreator NTSC Video Output, External Box
D–VCOP	VideoCreator PAL Video Output, External Box
	Cables and Supplies
X5–SCSI	SCSI Adapter Cable from SCSI–1 to SCSI–2 High Density
X5–9TO8	Serial Port Adapter Cable Mini Din to DB9
X5–ARCTTO8	Serial Port Adapter Cable Mini Din to ARC DB9
X5–13BNC	Monitor Cable 13W3 to BNC
X5–25TO8	Indigo Modem Cable
X5–T13D	Blank 1.3GB DAT Cartridge Tape (QTY 5)
X5–T20D	Blank 2.0GB DAT Cartridge Tape (QTY 5)

Section 13

Questions and Answers

Corporate:

Q: Where does this product fit in the overall corporate product line?

A: This is the newest member of the Indigo product family. It is the high performance, top of the line Indigo.

Marketing

Q: How can you call a green computer "Indigo"?

A: "Indigo" isn't a color; it's our design philosophy. "Indigo" represents the concepts and technologies behind the desktop computer revolution that stared with the IRIS Indigo workstation in July of 1991. This concept has evolved over time through the addition of enhancements to Graphics, CPU and Digital Media. The concept is continuing to evolve with Indigo2 which brings high performance graphics capabilities and industry standard expandability to the Indigo family. Both products continue to combine the power of Workstations with the ease of use and standards of PC's.

Q: Why has SGI gone to a new desktop chassis?

A: We have gone to a new chassis for a couple of reasons. One is that we set out to design the World's most powerful desktop workstation with Indigo2. SGI felt it was necessary to add an industry standard EISA bus in addition to the high performance Indigo GIO bus as well as other features such as a second SCSI channel & larger power supply and internal CD ROM. All this required a chassis redesign.

Q: Why is SGI announcing the 150 MHz in advance of commercial availability?

A: We feel it is important to let our customers know our future directions. The processor upgrades are integral to the long term value of this system.

Q: Is FDDI available ?

A: Yes, an FDDI board will be available the quarter following announcement.

Q: Why does SGI quote 100 MHz & 150 MHz processor speeds?

A: These are the internal clock speeds for the R4000/100 MHz and R4400/150 MHz processors

respectively. We are quoting the internal clock rate as this is the clock speed of the chip and it has become the norm in the industry to quote processor performance this way.

Q: How can you claim the power desktop lead given HP's processor performance?

A: We do not believe the power desktop is defined solely by the clock speed of the CPU. Instead, power is determined by the overall system performance as measured by application performance, of which CPU is one component of many. System throughput is determined by the following system components:

- Integer Performance
- Floating Point Performance
- Cache Speed
- Cache Size
- Main Memory Speed
- System Bus Bandwidth
- Graphics Speed
- Disk Performance
- I/O and Network Performance
- O/S tuning and context switching

The overall integration of these factors is what makes Indigo2 the fastest.

Q: How many open EISA slots do I have for Expandability with Indigo Extreme Graphics in the system?

A: With Indigo Extreme Graphics in the system there is one available slot that can be used for either an EISA card or a GIO card.

Q: SGI has always had the fastest I/O in the industry, What improvements have been made with Indigo2?

A: We have implemented two Fast SCSI –2 channels on the system to allow for increased throughput as well as greater expandability in terms of number of devices. This along with the high performance of our disk drives will allow SGI to continue to have outstanding I/O performance.

Q: Will Audio be optional?

A: No, Audio is a core technology & comes standard on all Indigo systems within the Indigo family.

Q: How will Indigo2 be sold?

A: Indigo2 will be sold through a combination of Direct Sales, OEM's & VARS.

Q: What are the key differences between Indigo & Indigo2?

A: Indigo2 brings the following to the Indigo Family:

- 2X graphics performance with Extreme Graphics
- 2X the Bus bandwidth with a full 64Bit system architecture.
- 2 fast SCSI II channels instead of 1.
- EISA in addition to GIO expansion capibilities.
- 10BaseT in addition to AUI Ethernet support.
- 6 simultaneous audio channels instead of 4.
- 5 1/4" internal support.

Software

Q: Will Indigo2 run NT?

A: NT on Indigo2 is not part of our January product announcement. We currently have products, the Magnum and Millennium lines, that run NT and we continue to sell them to NT software developers and OEM's. In addition we continue to work closely with Microsoft to incorporate the OpenGL™ into the next version of Windows NT.

Q: Will current Software run on Indigo2?

A: Indigo2 will ship on a revision of 4.0.5 which is currently shipping. Applications should run without a problem on this system.

Graphics

Q: Why is Extreme Graphics offered only in the Indigo2 chassis?

A: Extreme will also be supported on Iris Crimson workstations, but not in the Indigo chassis because it physically does not fit.

Q: Can users obtain "E-class" graphics on systems other than Indigo2 workstations?

A: E-class graphics refers to our high end desktop graphics. Today that includes both Elan

Graphics on IRIS Indigo and Extreme Graphics on Indigo2 and Crimson products.

Q: What is the difference between "X-class" & "E-class" graphics?

A: X class refers to our midrange 8 & 24 bit desktop graphics offerings. These products on the Indigo include XS, XS24, XS24Z, & XZ. These products are aimed at the price/performance sensitive segment of the marketplace. E-class refers to Elan and Extreme graphics which target high end application segments like Animation, Visual Simulation, and high end Mechanical CAD.

Technical

Q: Why did SGI choose a 1MB cache size?

A: A 1MB secondary cache is the optimal size of cache in terms of price performance. As the technology evolves we will be able to adjust cache sizes on the processor module through an easy module upgrade. Having the daughter card processor module makes it easy for us to provide different CPU offerings as they become available.

Q: Why not offer a lower secondary cache size like 512KB?

A: There is not much cost savings in going to the smaller cache size and the performance decrease can be substantial. Having the daughter card processor module makes it easy for us to provide different CPU offerings as they become available and make sense.

Q: Why not offer a higher secondary cache size like 2MB?

A: In this case the increased performance does not justify the cost and number of components we would have to use to implement the higher cache size. Having the daughter card processor module makes it easy for us to provide different CPU offerings as the become available and make sense.

Q: What is new about the system?

A: The major difference from a performance standpoint is that this system includes a 64 bit system bus architecture leading to a doubling of system bus speed. Other major differences include the addition of an EISA bus and second Fast SCSI channel for increased expandability. The ability to support Edge Graphics, 10baseT on the motherboard, internal CD ROM support, and two additional audio channels giving Indigo2 support for six simultaneously are also different about the system.

Q: Will future CPU's be daughter card upgrades?

A: Yes, upgrades will require the simple daughter card swap.

Digital Media – Indigo Magic

Q: What are the plans for Video in Indigo2?

A: Indigo2 Extreme has a dedicated video bus like the original Indigo workstation. We plan our systems with Video as a core technology capability for Silicon Graphics and the system has been designed with Digital Media in mind. A Video board is currently under development and will be available later this year.

Q: What's new about INDIGO Magic?

A: The concept of INDIGO Magic is what's new. This is not a list of extras -- its an integral concept that SGI continues to develop as we advance the Indigo technology. There are also some important new releases, Showcase 3.0; IRIS Explorer 2.0 (just announced in Nov) for example.

Q: Why is it INDIGO Magic if it runs on all the SGI platforms?

A: The Indigo concept is changing the way all of our platforms are made and used, just as it's changing the industry's definition of the desktop workstation. Just as Indigo benefits from technology developed at the the high end of our line, the high end is extended to include the powerful Indigo Magic functionality. This is made possible by the product–line–wide binary compatibility that is unique to SGI.

Q: Why no collaborative/shared applications? When?

A: Collaborative applications are the logical next step for Magic. Our first objective was to complete the richest desktop–based digital media environment for end–users and developers in the industry. We are already entering the realm of distribute media ,of which collaborative applications are a part with media mail. Expect collaborative applications in CY 93

Q: Is this a product?

A: Indigo Magic is an integral part of the Indigo concept. The core elements of Magic are the essence of what our systems are trying to help users achieve. In this sense, they are part of a product — the Indigos and other SGI systems -- but not a separate line item themselves.

This is why the core elements of Magic are bundled with every system.

BUS Expandability

Q: Why did SGI choose the ISA/EISA bus in addition to GIO?

A: We selected the EISA bus because it is the bus with the most cards available ranging from General Communication (FAX/MODEM) to Networking (ISDN & IBM Comm) and Digital Media (Synthesizer Boards). The GIO bus is still required for high bandwidth performance sensitive needs like FDDI, image processing & Video. Our implementation of EISA fully conforms to the Version 3.12 of the EISA Standard.

Q: What is SGI doing to get Third party solutions on this platform?

A: We are handling this from a number of fronts:

1.) Providing 3rd Party's with system access
- Gold Seal Lab for porting
- Systems in Porting centers (world wide)
- Developer discount on systems

2.) Development Program – IRIS Advantage
- EISA Device Drivers Guide
- Sample Driver templates
- Names of available contract Device Driver writers
- Developer Discounts

3.) Technical Support
- FAX/Email address to send in questions to devsupport@sgi.com
- Names of available contract Device Driver writers

Q: Why doesn't SGI provide cards on their price list?

A: We selected EISA because there are such a wide range of cards available from 3rd parties. We will provide our own cards where there is a need for which there is not an adequate 3rd party solution.

Q: How long will it take before we start to see solutions available?

A: We have already begun working with partners such as Specialix, SSI, Bit3, and Intel. Given this head start we anticipate cards to be available shortly after the product is available with SVR4 (Summer time frame).

Q: Is it really easy for people to provide EISA solutions for Indigo2?

A: For people experienced with EISA & UNIX it should be fairly straight forward. Also, We are providing a developers kit and access to technical assistance for our developers. Experience has shown us that going from a SCO unix driver should only take a few days.